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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 09/878,803 | 06/11/2001 | Min Ho Jung | 30205/37328 | 3762 |

4743 7590 05/19/2003

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EXAMINER

THORNTON, YVETTE C

| | |
|----------|--------------|
| ART UNIT | PAPER NUMBER |
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1752

DATE MAILED: 05/19/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application N .

09/878,803

Examin r

Yvette C. Thornton

Applicant(s)

JUNG ET AL.

Art Unit

1752

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 March 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 4 and 13-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3 and 5-12 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 June 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

This is written in reference to application number 09/878803 filed on June 11, 2001 and published as US 2002/0022197 A1 on February 21, 2002.

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Election/Restrictions

2. Applicant's election with traverse of claims 1-3 and 5-12 in Paper No. 7 is acknowledged. The traversal is on the ground(s) that any searched conducted by the examiner would necessarily cover Group I and II and further any search regarding the subject matter of group III would necessarily cover the subject matter of group I. This is not found persuasive because while a complete search of the claimed product would include a determination of whether the claimed composition has been previously used or made, it does not limit the examiner to any given method of making or method of using as set forth in the non-elected groups. The examiner reserves the right to rejoin the process claims if the product claims are found to be allowable.
3. Applicants further argue that the examiner has set forth unrealistic hypothetical examples in the restriction requirement. The examiner directs the applicant's attention to U.S. Patent Number 5,580,694 (Allen), which teaches the use of a photoresist composition wherein a pattern is formed without using a reflow process; and U.S. Patent Number 5,276,126 (Rogler), which teaches the use of a photoresist composition to make a planarizing layer, which is not irradiated. Groups I-III each have acquired separate status in the art as

shown by their different classification, restriction for examination purposes as indicated in Paper No. 6 is proper.

4. The requirement is still deemed proper and is therefore made FINAL.
5. Claims 4 and 13-20 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected inventions, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in Paper No. 7.
6. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Objections

7. Claims 2, 5 and 7 are objected to because of the following informalities: the said claims fail to have a period at the end. Appropriate correction is required.

Claim Rejections - 35 USC § 102

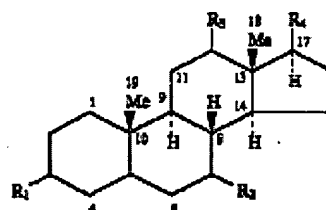
8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Art Unit: 1752

9. Claims 1-3, 5 and 8-12 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Allen et al. (US 5,580,694 A). Allen teaches a radiation sensitive resist composition comprising (a) a radiation sensitive acid generator, (b) a substituted androstane, and (c) a copolymer binder (abstract). Allen teaches that suitable substituted androstanes for



use in the taught invention are represented by formula

wherein

R_1 , R_2 and R_3 are hydrogen, C_{1-4} alkylcarbonyloxy or C_{1-4} haloalkylcarbonyloxy and R_4 is a tertiary alkoxy carbonylalkyl preferably lower (C_{4-8}) tertiary alkoxy carbonyl lower (C_{1-10}) alkyl. Preferred compounds are lithocholates having the hydroxy group protected with a protecting substituent such as acetyl or fluoroacetyl substituent. Specific preferred compounds are tertiary alkyl-(3-alkyl or haloalkyl carbonyl) lithocholate such as t-butyl 3-acetyl lithocholate and t-butyl 3-trifluoroacetyl lithocholate (c. 3, l. 21-46). Suitable examples of the acid generator include triphenylsulfonium triflate, bis-(t-butyl phenyl) iodonium triflate, and triarylsulfonium and diaryl iodonium hexafluorantimonates (c. 3, l. 47-61). Allen teaches that the three-component resist composition comprises about 1-10 weight% of the acid generator, about 10-40 weight% of the substituted androstane, and about 50-90 weight% of the copolymer (c. 3, l. 62-67). Examples 1 and 2 exemplify a resist composition comprising a copolymer of methyl methacrylate/t-butyl methacrylate/methacrylic acid; photoacid generator bis-(t-butyl phenyl) iodonium triflate, t-butyl 3-acetyl lithocholate and cyclohexanone. It is the examiner's position that t-butyl 3-acetyl lithocholate is structurally

Art Unit: 1752

analogous to claimed formula 2. Examples 1 and 2 further exemplify a process wherein the said composition is coated on a silicon wafer, baked, exposed and developed to form a pattern. Although, Allen does not exemplify the use of triphenylsulfonium triflate or triarylsulfonium and diaryl iodonium hexafluorantimonates, one of ordinary skill in the art could readily envisage a composition wherein triphenylsulfonium triflate or triarylsulfonium and diaryl iodonium hexafluorantimonates are used as the photoacid generator.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

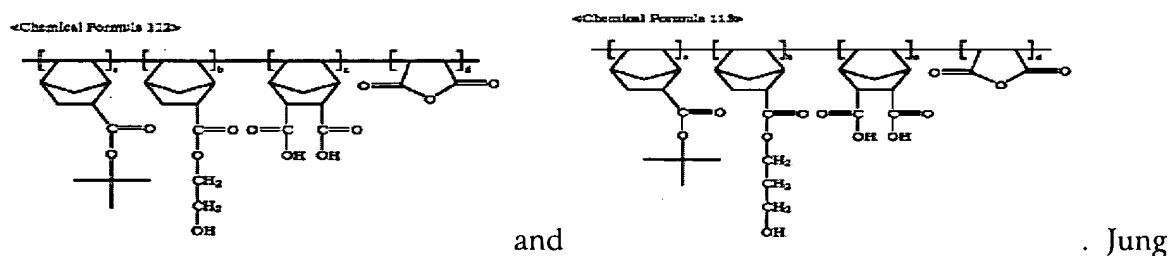
(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 1-3 and 5-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jung et al. (US 6,391,518 B1) in view of Allen et al. (US 5,580,694 A).

12. The applied reference of Jung (US 6,391,518 B1) has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or

(3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). For applications filed on or after November 29, 1999, this rejection might also be overcome by showing that the subject matter of the reference and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person. See MPEP § 706.02(l)(1) and § 706.02(l)(2).

Jung exemplifies in examples 24 and 25 a composition comprising a polymer of example 12 and example 13 respectively, and triphenylsulfonium triflate as a photoacid generator dissolved in ethyl 3-ethoxypropionate solvent. The said composition was spin-coated on a silicon wafer, baked, exposed and developed to form a pattern (c. 13, l. 35-c.14, l. 50; c. 15, l. 31-40). The polymers of examples 12 and 13 have the following structures:

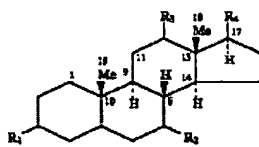


teaches that the polymerization ratio of a:b:c:d is (0.01-99 mole%):(0.01-99 mole%):(0.01-99 mole%):(0.01-99 mole%) (c. 6, l. 38-67). One of ordinary skill in the art would have been motivated to adjust the polymerization ratio within the taught range to achieve optimal results. *In re Boesch* {617 F.2d 272, 205 USPQ 215 (CCPA 1980)} has established that it is not inventive to discover optimum or workable ranges by routine experimentation where

Art Unit: 1752

general conditions are disclosed in the prior art. Jung however fails to teach the addition of a separate compound having the claimed structure 1 as set forth in the instant claims.

Allen as discussed above teaches a radiation sensitive resist composition comprising (a) a radiation sensitive acid generator, (b) a substituted androstane, and (c) a copolymer binder (abstract). Allen teaches that suitable substituted androstanes for use in the taught



invention are represented by formula

wherein R_1 , R_2 and R_3 are

hydrogen, C_{1-4} alkylcarbonyloxy or C_{1-4} haloalkylcarbonyloxy and R_4 is a tertiary alkyoxycarbonylalkyl preferably lower (C_{4-8}) tertiary alkoxy carbonyl lower (C_{1-10}) alkyl.

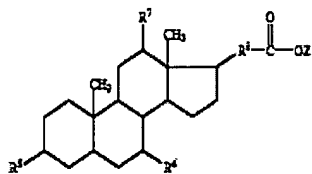
Preferred compounds are lithocholates having the hydroxy group protected with a protecting substituent such as acetyl or fluoroacetyl substituent. Specific preferred compounds are tertiary alkyl-(3-alkyl or haloalkyl carbonyl) lithocholate such as t-butyl 3-acetyllithocholate and t-butyl 3-trifluoroacetyllithocholate (c. 3, l. 21-46). It is the examiner's position that t-butyl 3-acetyllithocholate is structurally analogous to claimed formula 2. Allen teaches that the acid generated from the acid generator converts the androstane from dissolution inhibitor to dissolution enhancer, thereby increasing the solubility of the exposed resist composition in an aqueous base to achieve patterned dissolution differentiation (c. 4, l. 32-39). The androstane component also provides greatly enhanced etch resistance for subsequent process steps (c. 4, l. 54-56).

One of ordinary skill in the art would have been motivated by the teachings of Allen to incorporate an androstane compound such as t-butyl 3-acetyllithocholate into the

Art Unit: 1752

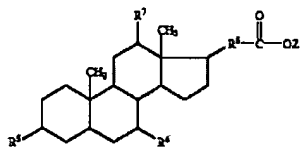
exemplified composition of Jung (ex. 24-25) in order to increase the solubility of the exposed resist composition in an aqueous base to achieve patterned dissolution differentiation (c. 4, l. 32-39) and to greatly enhance etch resistance for subsequent process steps (c. 4, l. 54-56).

13. Claims 1-3, 5 and 8-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kajita et al. (US 6,180,316 B1). Kajita teaches a second embodiment wherein a radiation sensitive resin composition comprises (A') a polymer containing recurring unit (I) of formula (1), (B') a photoacid generator, and (C') an androstane-17-carboxylic acid ester



compound of formula 5: (c. 4, l. 10-45). The said polymer (A') can possess the acid decomposable group (i) as the substitution groups A and/or B in the recurring unit (I) and one or more "other recurring unit". The said polymer may also contain at least on recurring unit selected from a recurring unit obtained by the cleavage of a polymerizable carbon-carbon double bond of norbornene or norbornene derivative (c. 24, l. 24-65). Acid generators, which are particularly preferable, include diphenyliodonium trifluoromethane-sulfonate (triflate), triphenylsulfonium trifluoromethanesulfonate and dimethyl (2-oxocyclo-hexyl) sulfonium trifluoromethanesulfonate (c. 25, l. 45-49; c. 18, l. 57-c. 19, l. 10). To optimize and balance sensitivity and developability as a resist, the amount of the acid generator (B') used in the composition of the second invention is usually from 0.1 to 10 parts by weight of the polymer (A') (c. 25, l. 60-c. 26, l. 2). The compound (C') is a

Art Unit: 1752



compound of formula (5): wherein R^{5-7} is preferably of the groups methoxy, ethoxy, methyl carbonyloxy, trifluoromethyl carbonyloxy, trichloromethyl carbonyloxy, and tribromomethyl carbonyloxy. A hydrogen atom or hydroxyl group is particularly preferred as the groups R^{5-7} in formula (5) (c. 26, l. 36-41). The ideal example of the divalent organic group represented by R^8 is $-\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2-$ (c. 26, l. 52-55). When the Z group of the said androstane compound (C') has an oxygen atom and an acid decomposable group, the said acid decomposable group dissociates by exposure to radiation and produces a polar group. This provides the radiation sensitive resin composition with polarity, which results in improvement in developing properties and increases adhesion to substrates (c. 6, l. 59-65). Particularly preferably groups for Z are t-butyloxycarbonylmethyl, 2-ethoxyethyl, 2-cyclohexyloxyethyl, 3-oxocyclohexyl, tetrahydropyranyl, and 2-oxo-4-methyl-4-tetrahydropyranyl (c. 27, l. 51-55). The amount of androstane compounds used in the composition is usually from 5-50 parts by weight for 100 parts by weight of the polymer (A') (c. 28, l. 12-19). The resin composition is prepared by dissolving the solid components in a suitable solvent. Particularly preferred solvents include cyclic ketones, linear ketones, propylene glycol monoalkyl ester acetates and alkyl 2-hydroxypropionates (c. 28, l. 20-26; c. 23, l. 2-4; c. 22, l. 21-67). The taught composition is applied to a substrate, pre-baked, exposed, post-exposure baked, and developed (c. 28, l. 20-26; c. 23, l. 18-c. 24, l. 21). It is the examiner's position that when R^5 is methyl carbonyloxy; R^6 and R^7 are hydrogen; R^8 is $-\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2-$ and Z is 2-ethoxyethyl, the limitations of claimed formula 3 are met.

Art Unit: 1752

Further when R⁵ and R⁷ are methyl carbonyloxy; R⁶ is hydrogen; R⁸ is -CH(CH₃)CH₂CH₂- and Z is 2-ethoxyethyl, the limitations of claimed formula 5 are met. The limitations of claimed formula 7 are met when R⁵⁻⁷ are methyl carbonyloxy; R⁸ is -CH(CH₃)CH₂CH₂- and Z is 2-ethoxyethyl.

One of ordinary skill in the art would have been motivated by the teaching of Kajita to develop a composition comprising a photoresist polymer (A'), a photoacid generator (B') and an androstane compound (C') of formula (5) wherein the R⁵⁻⁷ is preferably H, OH, or C1-2 alkyl carbonyloxy group such as methyl carbonyloxy, R⁸ is ideally -CH(CH₃)CH₂CH₂- and Z is the particularly preferred group 2-ethoxyethyl in order to obtain a radiation sensitive composition which is sensitive to deep UV, exhibits high transparency, high resolution and has excellent property balance such as pattern configuration and sensitivity (c. 2, l. 60-67).

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Kim et al. (US 6,497,987 B1) which teaches a photosensitive lithocholate derivative and chemically amplified photoresist composition containing the same.
- Park et al. (US 6,268,106 B1) which teaches a chemically amplified positive photoresist composition.
- Houlihan et al. (US 5,998,099 A) pertaining to an energy sensitive resist material and a process for device fabrication using an energy sensitive resist material.
- Allen et al. (US 5,786,131 A) pertaining to process for use of a photoresist composition with deep UV radiation {continuation of US 5,580,694 discussed above}.

Art Unit: 1752

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yvette C. Thornton whose telephone number is 703-305-0589. The examiner can normally be reached on Monday-Thursday 8-6:30.

16. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Janet C. Baxter can be reached on 703-308-2303. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

17. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-1495.



Yvette Clarke Thornton
Junior Examiner
Art Unit 1752

yct
May 15, 2003